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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/944,718	08/31/2001	Kevin Ray Anderson	11936.12US01	1730

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EXAMINER
HUG, ERIC J

ART UNIT	PAPER NUMBER
1731	8

DATE MAILED: 04/24/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/944,718	Applicant(s) ANDERSON ET AL.	
	Examiner Eric Hug	Art Unit 1731	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 February 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *3-25* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *3-8 and 17-25* is/are rejected.

7)☒ Claim(s) *9-16* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 3-8 and 17-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over LeRoy et al (US 3,553,193) in view of Curtis (US 3,299,052) and Stange et al (US 4,949,514). LeRoy discloses a method of making carbonyl containing starches by oxidation of starch with an alkali metal hypobromite or alkali metal bromite, resulting in a starch with substantially more carbonyl groups than carboxyl groups. The oxidation process is selective so that ideally the hydroxyl group on the side chain of the starch unit is oxidized to carbonyl and the hydroxyl groups directly on the starch unit are not oxidized. LeRoy teaches that such starches are preferred for reacting with amine reagents to form derivatives and can replace dialdehyde starches for the same end uses. The starches are useful in treating paper to improve wet strength and other properties. The starch can be reacted with amines such as urea-formaldehyde resins (column 5, line 70), and used in applications where the resins are normally employed (such as in paper). In Tables 1-5, carbonyl and carboxyl amounts expressed as degree of substitution (D.S.) are provided for starches made at different pH, at different oxidant/starch ratios, and from different starch types.

The conversion from D.S. to microequivalents is described below. From this conversion, the claimed carbonyl level of 5 microequivalents per gram of starch (claim 5) is equivalent to a

D.S. of 0.00093, and the claimed carbonyl level of 300 microequivalents per gram of starch (claim 7) is equivalent to a D.S. of 0.0558. Some of the starches tabulated in LeRoy have a carbonyl D.S. between 0.00093 and 0.0558, thus they have carbonyl amounts within the claimed carbonyl range of 5-300 microequivalents per gram. Also, some of the starches exceed the claimed carbonyl:carboxyl ratio of 2.5:1 (claim 18). The first two starches in Table 3, as examples, read on both the carbonyl content range and the carbonyl:carboxyl range.

The properties of the carbonyl starch of LeRoy read on the starch properties of claims 5-8, 17, and 18. LeRoy teaches that the starches can be used in paper making, added by size press or by beater addition (wet end). LeRoy also teaches that amines can be reacted with the starches for the same applications (column 5, lines 28-72). A urea-formaldehyde resin is disclosed as a possible amine, but no other amines are mentioned nor are any specific examples of making paper with aminated carbonyl starches disclosed.

Curtis discloses dispersible starch mixtures comprising dialdehyde starches and hypochlorite oxidized starches. The mixtures are cationized with well known cationic agents, such as cationic starch, polymeric amines, or polyamides for use a strength additives in paper (column 2, line 64 to column 3, line 11).

Stange discloses a dry strength agent for paper or board by reacting an enzymatically degraded starch with a cationic polymer. One possible cationic polymer is a polymer of N-vinylamine. The enzymatic degradation of the starch is done in lieu of oxidation of starch by persulfate, peroxide, hypochlorite or hydroperoxide, so that the resulting dry strength agent retains better on a paper machine and the wastewater has lower COD values. From 1 to 20 parts of polymer per 100 parts of starch is used (1-20%). Thus, Stange teaches reacting a degraded

starch with a N-vinylamine polymer (polyvinylamine) for use in papermaking. The strength additives are added to the paper stock prior to drainage at a dosage of between 0.5-5.0% by weight based on dry stock (column 6, line 9).

Summarizing what the above prior art teaches:

- The prior art teaches making oxidized starch with at least the claimed carbonyl content.

- The prior art teaches making oxidized starch with low carboxyl content and having at least a carbonyl:carboxyl ratio above the claimed value.

- The prior art teaches that carbonyl-containing starch can be reacted with polymeric amines for making paper additives.

- The prior art teaches that polyvinylamine is a suitable polymeric amine for making papermaking additives.

- The prior art teaches adding starch-amine papermaking additives at the wet end of the paper machine.

Therefore, at the time of the invention, it would have been obvious to one skilled in the art to make a composition comprising a high carbonyl-low carboxyl oxidized starch and a reactive amine polymer such as polyvinylamine for use as a strength additive in paper making. One would be motivated to use a high carbonyl-low carboxyl starch because it is highly reactive to amines, and because the resulting starch-amine composition retains better on the paper machine than compositions made from high carboxyl-containing starches.

The relationship between D.S. and microequivalents per gram is discussed as follows:

Carbonyl group CH=O: = 29 g/equivalent

Starch unit $C_6H_{12}O_6$: = 180 g/equivalent

Dialdehyde starch = 2 aldehydes (carbonyls) per starch unit

= 2 equivalents aldehyde/equivalent of starch

= 2 equivalents aldehyde/180 g starch

= 0.011 equivalents aldehyde/g starch

= 11.11 milliequivalents aldehyde/g starch

= 11110 microequivalents aldehyde/g starch

= 58 g aldehyde/180 g starch

= 0.32 g aldehyde /g starch

= 32% aldehyde

Using the above conversions, a starch comprising 11.1 microequivalents aldehyde/g starch calculates to 0.032% aldehyde.

Applicant gives the following measured data for the starch of the present invention:

0.2 microequivalents carbonyl/g starch = 0.0006% carbonyl

2.2 microequivalents carbonyl/g starch = 0.0063% carbonyl

11.4 microequivalents carbonyl/g starch = 0.033% carbonyl, which is approximate the quantities calculated above. Thus, the calculations given above are consistent with Applicant's findings.

Degree of Substitution (D.S.) = maximum of 3.0 for starch because of the presence of three oxidizable hydroxyl groups per starch unit. A dialdehyde starch has D.S. of 2. Therefore, D.S.=2 is equivalent to 11110 microequivalents/ g starch. Converting Applicant's range of 5-300 microequivalents carbonyl/ g starch:

5 microequivalents carbonyl/g starch =

0.0144% carbonyl = D.S. of 0.00093.

300 microequivalents carbonyl/g starch =

0.86% carbonyl =D.S. of 0.0558.

These values of D.S. were used above in the discussion of the starches of LeRoy.

Allowable Subject Matter

Claims 9-16 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter:

The prior art does not disclose or suggest a composition comprising a starch having reactive carbonyl groups and comprising a polymer having carbonyl reactive functionality, whereby the starch has between 5-300 microequivalents of reactive carbonyl per gram of starch and a carbonyl:carboxyl ratio of at least 1:1, whereby the starch has been prepared by oxidation with periodate, hypochlorite, ozone, peroxide, hydroperoxide, hydrogen peroxide, persulfate, percarbonate, or mixtures thereof.

LeRoy teaches against using hypochlorites as oxidizing agents, as they are less selective to specific hydroxyl groups and do not provide the desired proportion of carbonyl to carboxyl. BeMiller teaches that ferrate oxidation is different from other oxidation methods, such as hypochlorite oxidation that results in the formation of carboxyl, aldehyde, and keto groups plus scission of the starch chain, or periodate oxidation which cleaves the carbon-carbon bond at the 2,3 positions in the starch unit with formation of two carbonyl groups (dialdehyde starch). Prior art methods of making carbonyl-containing starches with periodate, hypochlorite, ozone, peroxide, hydroperoxide, hydrogen peroxide, persulfate, or percarbonate oxidizing agents result in starches having a carbonyl content much greater than 300 microequivalents per gram and/or a substantially greater carboxyl content such that the carbonyl:carboxyl ratio is less than 1.0. Thus, it is not taught or suggested to make an oxidized starch within the claimed range of carbonyl content and with at least the claimed carbonyl:carboxyl ratio using the claimed oxidizing methods.

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

Slager (US 3,086,969) discloses periodate oxidation of starches to dialdehyde starches with a yield of close to 100% (complete conversion to the dialdehyde).

Floyd et al (US 3,138,473) discloses compositions for increasing the wet strength of paper comprising fatty-acid derived amine compounds adducted with dialdehyde starch. The amine compounds are prepared from polymeric fatty acids and polyamines.

Moskaluk (US 3,615,786) discloses hypochlorite oxidized starches having 0.03% carbonyl and 0.05% carboxyl content.

BeMiller et al (US 3,632,802) discloses starches that have been oxidized with an alkali metal ferrate to yield starches having primarily aldehyde (carbonyl) groups and without the formation of carboxyl groups. The products can be used in applications such as paper.

Powers et al (US 3,649,624) discloses carboxyl starch amine ethers for use in paper coating compositions, made by first oxidizing starch with hypochlorite to form carboxyl-containing starch, then reacting the carboxyl groups with amine compounds.

Aitken et al (US 4,097,427) discloses a method for cationizing starch with a water-soluble quaternary ammonium polymer in the presence of an oxidizing agent.

Watts, Jr. et al (US 4,122,253) discloses a starch derivative made by treating an oxidized starch with a dialkyl amine having up to 18 carbon atoms. The starch is made having carbonyl and/or carboxyl groups from using conventional oxidizing agents such as periodate or hypochlorite (with periodate being the preferred method for yielding dialdehyde starch). The resulting derivatives are useful as strength additives for paper.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eric Hug whose telephone number is 703 308-1980. The examiner can normally be reached on Monday through Friday, 9:00 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Steven Griffin can be reached on 703 308-1164. The fax phone numbers for the organization where this application or proceeding is assigned are 703 872-9310 for regular communications and 703 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703 308-0651.

jeh
April 18, 2003

STEVEN P. GRIFFIN
SUPERVISORY PATENT EXAMINER
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